Project Lead:	Ken Fonorow Florida H.E.R.O.

OVERVIEW

Atlantic Design & Construction is a small, privately held residential construction company located in Gainesville, Florida. Founded in 1985, the firm now directly employs 15 full-time employees and sells about 50 - 60 homes a year. Like any business, Atlantic Design & Construction is interested in both short-term and long-term profitability. Showing this multiple award-winning company how they could increase their profits when they actively promoted Energy Star and Building America was the key to a successful partnership. Though initially producing homes better than the Florida Energy Code minimum, the company considered, included, then actively promoted concepts and measures they found effective in both cost and value. Despite adding $1250 - $2500 to home buyer costs up-front, this award-winning development has been the best-selling subdivision in Alachua County for four years running. Never afraid to be on the leading edge, Atlantic Design & Construction has embraced more and more stringent standards over the years, pioneering new concepts and technologies and making them standard features in all of the homes they build.

Show me the money!! O.K.!!!

Among the most consistent refrains heard from decision makers is that if the initially higher priced health and energy efficient features REALLY do add value, why is it not recognized by appraisers and lenders? For example, if a 12 SEER A/C system is installed, as opposed to a code minimum, 10 SEER, why does the home appraise for the exact same amount? Often I hear builders justifying their decision not to provide more efficient housing because of their desire to maximize "afford ability." You know, the lower the initial price of the home, the more affordable it is. Wrong!!

As this project is one of the earliest adopters of the Energy Star homes program, it has had an opportunity to "mature" or age. In addition, as it began as a standard subdivision, there are numerous examples of various different resales to consider. The results are staggering. Independent researchers have discovered that the more "expensive" efficient homes, actually cost less to own and operate, then the more "affordable" standard homes.

Most recently, while researching comparables, an independent, licensed residential Appraiser noted a significant differential of sale prices in what would appear to be identical homes. What he found should serve as a wake up call for the construction industry. Please

note that this is not some vague assertion of value, or the results of a generic survey, but rather based on actual sales. The Energy Star homes are selling for more than the exact same non-Energy Star homes. An example was provided that the increase in appraised value was $4,000 on a 1,550 square foot home. The initial price for the upgrades was only $1,250. As the Appraiser has said, this represents, "Value that actually exceeds costs."

CONVINCING THE BUILDER

Persistence.
More than a dozen calls and office drop-bys culminated in an informal conversation at a Builder Association luncheon with Atlantic Design & Construction (AD) president.

Figure 1.

This informal meeting opened the door to a more formal meeting with the production superintendent - a stepping stone in the company's protocol for implementing any long-term construction process or feature changes. Convincing the superintendent, that quantifying a home's construction quality would either verify the validity of present staff and subcontractor procedures or expose areas of concern, was a critical step. The superintendent agreed to allow Ken Fonorow, President of Florida HERO (applied Building Science consultant) to conduct performance tests on the model center and a recently completed home. A computerized multipoint whole house depressurization test, along with duct blaster tests, both "total" and "to out" were performed with the superintendent in attendance. The builder/president was apprized on the results of this inspection.

Two factors leaned in the favor of implementing quality control/energy cost changes if any were determined necessary. First, the client genuinely had the desire to do the right thing and wanted to provide his clients with a quality home. If the quality of that product could be quantified - all the better. Second, AD had just shifted from a custom homebuilding company to a production company with this subdivision. Though they were already exceeding the minimum Florida Energy code required, they were still flexible enough in these early stages to consider practice changes if those changes could be streamlined/standardized to minimize disruption to the production schedule. Any changes to the production procedures or standard features, however, would need to be backed with proof of their efficacy.

Engagement.
Results of the duct blaster tests found significant duct leakage - more than 30% of fan flow in the homes tested. This inspection also unearthed a potentially hazardous gas furnace installation with the single wall-flue in direct contact with wood. Engaging the superintendent in these home evaluations gave him a more independent vantage point and convinced him that new quality control procedures should be implemented. These results, passed from the superintendent to the builder/president, resulted in a face-to-face meeting with the consultant and the builder, who was now ready to hear about incorporating a systems approach to control production quality. The builder meeting covered a plethora of topics from safety issues to mechanical equipment right-sizing and qualification for the

Energy Star Program. The meeting also created an opportunity to show the builder how improving their quality didn't mean a significant increase in overall costs or production time. These product changes also could reduce client call-backs and/or complaints and provide their clients with a more comfortable and efficient home.

At this point, AD was interested in determining what features would need to be added, and procedural changes made to market their product as Energy Star. To make that determination, FLHERO performed a room-by-room Manual J load calculation from building plans for a model/Parade home about to begin construction. Results found that right-sizing equipment with strict procedural insulation and mechanical system specifications developed by the consultant, allowed the mechanical system to be reduced by a full ton. Increasing the SEER from 10 to 12 resulted in the home meeting the minimum level required for Energy Star home certification (HERS score of 86 or greater). Savings derived from increasing the cooling system efficiency more than offset the additional $250 - $375 needed for improved duct sealing and insulation and air sealing protocol adjustments. This savings, while sufficient to offset the costs associated with improved sealing methods, is NOT enough to pay for all implemented measures. Increasing the price of the home by $1,250 - $2,500 was sufficient to cover all additional costs AND derive an excellent profit margin.
Following-up during duct rough-in with both mechanical and insulation contractors, allowed the consultant to explain/train subcontractors on adjusted specifications. The specifications eventually became the builder's job-bidding criteria for insulation and mechanical subcontractors.

Energy Star.
After the formal face-to-face meeting, the builder decided to include "Energy Star" on the home buyer option's checklist. By including Energy Star, the builder agreed to upgrade the cooling system efficiency to SEER 12, install an electronic programable thermostat, install sealed and verified ductwork and increase wall insulation to R-13. As one of a list of options, sales of the Energy Star option were not brisk initially. After a careful review of the options program, the consultant scheduled a second meeting with the president and superintendent pointing out that the Energy Star option was the most profitable option on their list. As a result of this meeting, marketing of Energy Star became more aggressive and included sales force training on selling the program. Now, buyers who didn't select Energy Star during the closing process were contacted directly by the superintendent. His goal was to explain the value of including energy efficiency, the loss of revenue from not selecting it, and allowed buyers a second chance to include the option. Finally, AD's President negotiated a deal with the preferred lender's mortgage broker that resulted in a 1/8th point discount of the prevailing rates for every home that was designated Energy Star. This allowed the sales representatives an opportunity to demonstrate how much it would COST the buyer NOT to select the Energy Star option! A study commissioned by the EPA and conducted by the University of Florida (UF) verified the derived savings from implemented improvements. By comparing the actual kW and therm usage from utility billing information, then comparing this to similarly sized and aged code minimum homes, UF determined that the most energy efficient homes built by AD resulted in a monthly ownership cost decrease. After more than 120 buyers in a row selected this option, it became a standard feature for the builder.

Building America.
With Energy Star so ingrained in the AD production process, FLHERO worked to ratchet-up the builder's home parameters by introducing him to Building America concepts. Having been exposed already to a systems engineering approach, the builder was primed to

consider additional ways they could enhance their homes and their marketability. Building America opened new avenues for them to increase energy efficiency, durability and enhance indoor air quality. Shifting their minimum standard upward to include a 13-SEER air-conditioning system, .90+ AFUE heating system and low-e spectrally selective glass, the builder also embraced positive home pressurization principles through the introduction of filtered outside air to the return side of the plenum. The new upgrades resulted in this production builder's homes achieving an average HERS score of 89.

Table 1. MEETING BUILDING AMERICA STANDARDS		
Treatment	**Before**	**After (89 HERS Score)**
Windows	double pane, clear	double pane, low-e SHGC .35
Ceiling Insulation	R-30 unfaced	R-30 unfaced
Wall Insulation	R-11 faced	R-13 unfaced
Air Conditioning SEER	10 to 12	13
Natural Gas Heating	AFUE .80	AFUE .92+
Natural Gas Water Heating	.57 efficiency	.57 efficiency
Combustion	unsealed	sealed
Outside Air	none	yes
Return Air	none	pressure balanced
Duct Leakag @ 25 Pa	30% of fan flow	<5% of fan flow
A/C Sizing	standard rule-of-thumb	right sizing
Thermostat	standard mercury	programmable
Recessed Lighting	standard	air loc

Though indoor air quality was a subject not yet broached - demonstrating the principles of air movement into a tightly constructed home was an "eye opening" experience for the superintendent. It quickly became clear to him that controlling how and where outside air was introduced into the home (positive pressurization) could make a big difference in the indoor air quality (IAQ). In a negatively pressurized home outside air is introduced into a home through inadvertent gaps around windows, doors or top and bottom wall plates. Installing a simple, low cost, non-mechanical fresh air system helps restrict the uncontrolled entry of hot, humid, pollen-laden air into a home and its interstitial areas. Including this fresh air system not only made AD's home more efficient, but more importantly it improved IAQ. This fresh air system now is a standard feature in all of the homes they build.

Location. Location. Location.

Blueprints called for garage air handler (AH) installations in this builder's standard home. In a hot and humid climate, this architectural design element alone can cause all sorts of problems for the homeowner. In moisture laden climates, ambient conditions in a garage can accelerate rusting in the ferrous heat exchanger and increase evaporator coil sweating, both of which reduce the life expectancy of the heating and cooling system. Any air leakage especially at the blower fan, the point of greatest pressure differential, can introduce the home to moisture, outdoor irritants, automobile exhaust and toxic fumes from the substances most people store in their garage. Insufficient insulation of the AH and leaks on the supply side also lead to moisture condensation on the equipment and its associated

duct work. On the return side of the system, ductwork holes bypass all filters and create a pathway for hot moist air and/or pollen laden outside air to enter the home.

An on-site demonstration with a simple smoke stick, made invisible air flows visible and clinched this builder's interest. Armed with a clearer understanding of the ramifications of locating the AH in the garage, the builder was convinced of the value of an indoor installation. Initial design modifications forced the mechanical contractor to work in a closeted space that was simply not large enough to allow a good installation. The addition of a ductboard plenum adjacent to the furnace from an extended return, made sealing the system almost impossible. Code also required the provision of high and low combustion air to a furnace located within the thermal envelope of a home. Supply of this combustion air put the closet into communication with the attic and resulted in the movement of attic air to the living space via holes in the system.

After multiple approaches were tried, an acceptable method was developed using a .90+ AFUE sealed combustion gas furnace. The sealed system eliminated the need for combustion air from the attic and allowed the equipment room to be completely sealed from the garage and the attic. Supply and return plenums were stubbed-out in the mechanical closet during rough-in, and duct, plenum and refrigerant lines were sealed to the sheetrock with an expandable foam at all seams and penetrations. During equipment set, the supply side plenum was first affixed, then completely sealed with mastic and pressure sensitive tape. A metal tap installed in the return air plenum at ceiling height, was attached to an insulated flex duct which was connected to a second tap on the furnace side. An insulated exterior door for the mechanical closet with appropriate weatherstripping and threshold sealing completed the installation. Realizing that this approach would increase profits by increasing the home's square footage and provide clients with a safer and more energy efficient home, location changes were made to all model blueprints.

LESSONS LEARNED

- Learn decision-making structure of targeted organization.
- Be persistent.
- Provide assistance in verifying construction and design procedures.
- Engage key decision-makers in the verification process.
- Present results to a builder in ways he or she can appreciate.
- Make recommendations that are within the builders budget, price points and available skill level of trades using available materials and home designs.
- Follow-up with technical training, information and/or assistance as needed to keep builder and staff engaged in the program.
- Conduct performance testing on every home to insure quality control during the commissioning process.

Figure 3. Damp spray cellulose covers walls of mechanical closet (in cond. space) and water heater cabinet in the garage. Home entry is on the far right.

Figure 4. Example of good mastic return connection seal.

Figure 5. Mastic sealing detail at the air handler return connection.

Figure 6. Mastic sealed attic supply duct and plenum.

Figure 7. Good insulation detail of blown cellulose installation and foam insulation around window frame.

Figure 8. Outside air provides controlled, filtered fresh air while maintaining household at positive pressure with reference to outside pressure.